Name	Date started	Target end date

GCE A LEVEL — BIOLOGY UNIT 3 QUESTION PACK

1074 (Legacy BY4) + 1075 (Legacy BY5) · New spec Unit 3 Topic 14 · A2 unit, first sat 2017, 90 marks, 2h paper

REVISE
.wales

BIOLOGY — UNIT 3 · HUMAN IMPACT ON THE ENVIRONMENT

3.8 Human impact — pollution, climate change, biodiversity loss and conservation

Anthropogenic threats to ecosystems: rising atmospheric CO_2 and global climate change, eutrophication and water pollution (e.g. sewage sludge nitrate leaching), the biodiversity cost of monoculture agriculture, and conservation strategies including carbon-footprint accounting.

LEGACY 2008 SPECIFICATION

Estimated time for entire question pack: ~48 min

Derived from the legacy BY4 / BY5 papers' pace of ~1.3 min/mark, padded for long-prose answers (30 marks over 3 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains every question from the legacy WJEC BY4 (and BY5, where relevant) papers (2008 modular spec, 2011–2017) that maps onto new-spec A2 Unit 3 Topic 14 (3.8).

Questions are ordered by source paper date.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — quality of written communication will affect marks. A calculator is allowed. Diagrams included in answers must be fully annotated.

For Examiner's use only

Q	Source	Max	Mark
1	BY5 Jun 13 Q5	11	
2	BY5 Jun 16 Q1	10	
3	BY5 Jun 17 Q3	9	
	Total	**30**	

Human Impact on the Environment — what the new spec asks

WJEC GCE A Level Biology (from 2015) · Unit 3: Energy, Homeostasis & the Environment · Topic 3.8.

Climate change

- Rising atmospheric CO_2 (~280 → >415 ppm since 1750).
- Burning fossil fuels + deforestation are the major sources.
- Greenhouse effect → warming, sea-level rise, shifted distributions.

Eutrophication

- Excess nitrates / phosphates from fertilisers + sewage enter waterways.
- Algal bloom → light reduction → submerged plants die.
- Decomposing organic matter depletes O_2 → fish die.

Pollution

- Sewage sludge nitrate leaching — injection < surface application.
- Heavy metals, pesticides, plastic micro-debris accumulate up food chains.
- Sulphur dioxide and nitrogen oxides → acid rain damage.

Biodiversity loss

- Monoculture plantations (e.g. bananas) reduce species & genetic diversity.
- Habitat fragmentation, invasive species, over-harvesting.
- Carbon footprint accounting and certification schemes try to incentivise change.

Conservation strategies

- Legal protection (e.g. SSSIs in the UK).
- Reintroduction, captive breeding, seed banks.
- Sustainable agriculture, agroforestry, marine protected areas.

Sustainability

- Meet current needs without compromising future generations.
- Renewable energy, sustainable fisheries quotas, reforestation.
- Three pillars: environmental, social, economic.

Crib sheet »

Human Impact on the Environment in one page

Quick-reference notes — revisit before each question.

CO_2 rising

~280 → >415 ppm since 1750.

Fossil fuel burning + deforestation.

Enhanced greenhouse effect.

Climate consequences

Warming, sea-level rise, range shifts.

Coral bleaching, ice loss, extreme weather.

Migration patterns disrupted.

Eutrophication

Nitrate / phosphate from fertilisers / sewage.

Algal bloom → shade → submerged plants die.

Decomposers strip O_2 → fish kill.

Sewage sludge

Inject below surface ⇒ less nitrate leaching.

Surface spread ⇒ rapid leaching to groundwater.

Trade-off: cost vs pollution.

Monoculture

Reduces species & genetic diversity.

Vulnerable to pests, disease (e.g. Panama).

Heavy inputs of fertiliser & pesticide.

Carbon footprint

Total CO_2-equivalent emissions of an activity / product.

Measured kg CO_2e.

Used to compare farming / transport options.

Conservation tools

Legal protection (SSSI), reserves, reintroduction.

Seed banks, captive breeding.

Sustainable agriculture / fisheries quotas.

Sustainability

Three pillars: environmental, social, economic.

Renewable energy, reforestation, circular economy.

Goal: meet needs without compromising future.

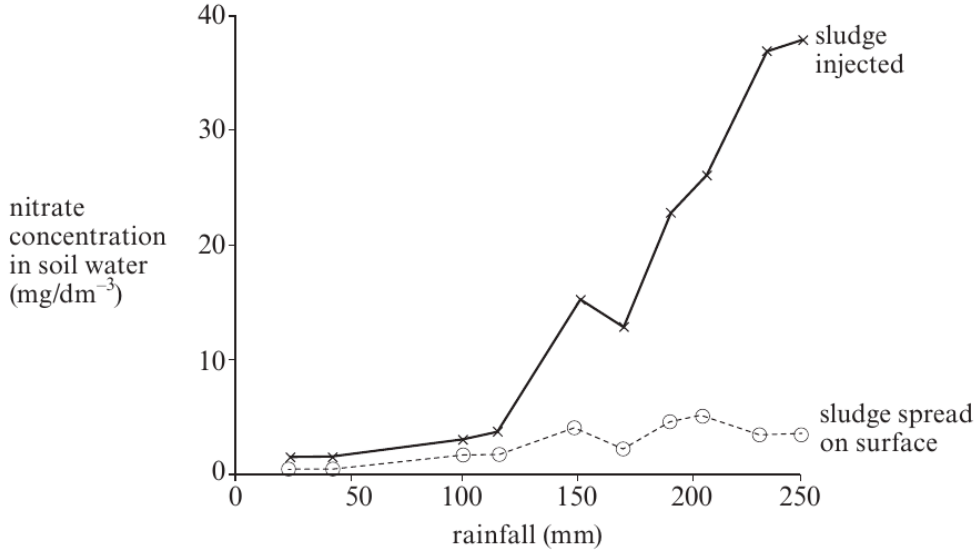
Examiner only

5. The treatment of sewage produces sludge as a product. This sludge contains high concentrations of nitrogen compounds such as nitrates and ammonia.

Experiments have been carried out into the leaching of nitrate from grassland to which sludge has been applied. The sludge was applied to two areas of grassland. On one area it was spread onto the surface whilst in the other it was injected at various points across the area.

The rate of leaching was measured by taking samples from the water flowing through the soil and measuring the concentration of nitrate in them after different volumes of rainfall had fallen.

The graph below shows the results obtained.



(a) (i) State **two** precautions that should be taken to ensure that the results are reliable. [2]

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(ii) Using the information in the graph describe fully the relationship between the leaching of nitrate and rainfall. [2]

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Examiner only

(iii) Using the data from the graph opposite, what advice would you give to a farmer as to the best time to apply sludge to the farmer's field for maximum benefit? [1]

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(b) The presence of high nitrate levels in rivers can lead to eutrophication. Briefly describe why eutrophication can result in the death of fish and many invertebrates in a river. [3]

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(c) Describe and explain what type of crops a farmer could grow to increase the nitrate level in the soil without using fertilisers, such as sludge. [3]

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Examiner only

Answer **all** *questions.*

1. *(a)* Bananas are grown on large plantations in tropical regions such as South America, using monoculture production methods.

(i) Define the terms:

I. biodiversity; [1]

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II. monoculture. [1]

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(ii) Describe and explain the effects of banana production on biodiversity in South America. [2]

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(b) Multinational banana companies own plantations, sea transport, ripening facilities and distribution networks in countries where the bananas are consumed. The data below was published by one such company.

	Banana Carbon Footprint (Farm-to-Retail Distribution Centre) /kg	
	USA	Europe
Per box (18kg)	18	24

(i) Define the term *'carbon footprint'*. [1]

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(ii) Explain the difference in the values for USA and the values for Europe. [2]

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Examiner only

(c) In an attempt to reduce their carbon footprint for their USA operation, the company switched to transporting the bananas part of the way by rail, instead of taking them the whole way by truck.

(i) Explain why this would reduce the carbon footprint. [2]

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(ii) How would this change benefit the environment? [1]

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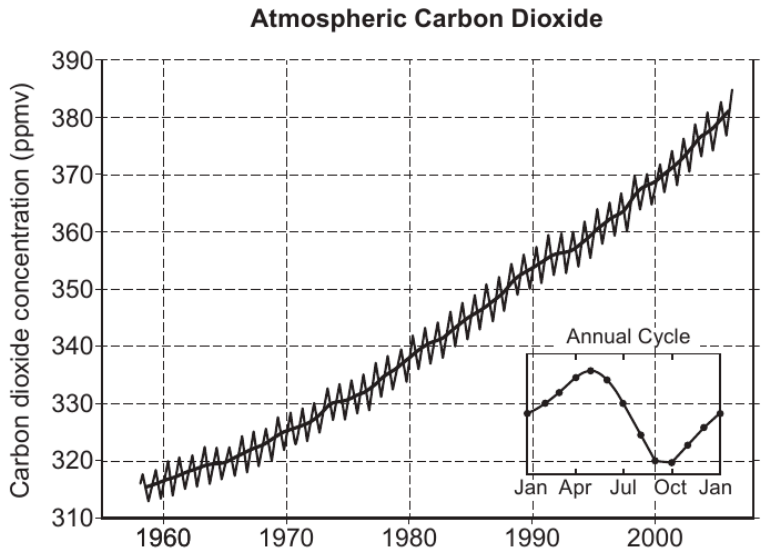
Examiner only

3. There is currently great concern about the concentration of carbon dioxide in the atmosphere. The graph below shows the results of measurements taken at one location in the USA.



(a) (i) Describe the trend over the years 1960 to 2000 shown in the graph. [1]

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(ii) The location is heavily forested. Explain how this might account for the annual cycle shown in the insert. [2]

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Most scientists agree that forest management can affect the atmospheric carbon dioxide level but there is disagreement about the best methods to manage forests in order to counteract the effects of climate change.

(b) Briefly explain the link between atmospheric carbon dioxide concentration and climate change. [2]

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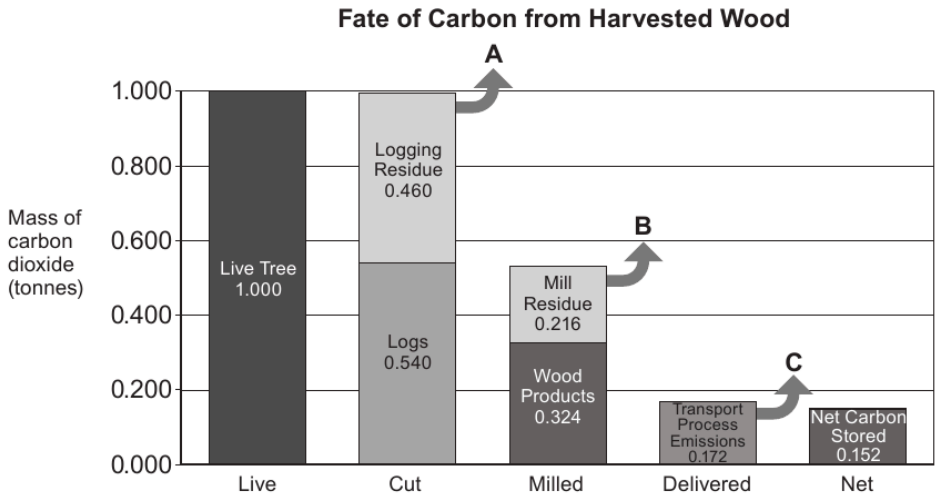
Examiner only

One group suggests that the best way to store the carbon fixed by forests is to harvest the trees and store it in wood products. The diagram below shows the fate of carbon atoms at each stage.



Data from Smith et al. 2006 and Gower et al. 2006.

Logging residue consists of stumps as well as thin branches and twigs at the tops of the trees. Mill residue consists of bark, shavings and strips of wood too thin to use.

(c) Calculate the percentage of carbon from a live tree which is stored in milled wood products. [2]

percentage of carbon = ... %

(d) Arrows **A**, **B** and **C** represent carbon returned to the atmosphere.

(i) Explain how the carbon would be returned to the atmosphere in **A** and **B**. [1]

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(ii) Explain why the net carbon stored is less than that stored in the milled wood products. [1]

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END OF QUESTION PACK

3 questions · 30 marks · ~48 min
Source: WJEC BY4 + BY5 (2008 modular spec, 2011–2017)
Curated for WJEC Biology 2015 spec A2 Unit 3 — Topic 14 (3.8)